REMARKS

No amendments are made to the claims and they are listed here only for convenience to the examiner:

1. (original) A method for forming a deep trench capacitor buried plate comprising:
   - providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;
   - performing a dry etching process for forming a deep trench in the substrate via the opening;
   - depositing a doped silicate glass film on an inner wall of the deep trench;
   - filling a sacrificial layer into the deep trench;
   - etching back the sacrificial layer for exposing parts of the doped silicate glass film;
   - removing the exposed doped silicate glass film;
   - removing the remaining sacrificial layer;
   - depositing a silicon nitride layer on the inner wall of the deep trench;
   - performing a thermal process for forming a doped region at a bottom of the trench;
   - removing the silicon nitride layer; and
   - removing the doped silicate glass film;
   - wherein the silicon nitride layer serves as a barrier layer for preventing ions of the doped silicate glass film from diffusing into a collar region of the deep trench.

2. (original) The method of claim 1 wherein the doped silicate glass film is an arsenic silicate glass (ASG) film.

3. (original) The method of claim 2 wherein the arsenic silicate glass film is formed by a chemical vapor deposition (CVD) process.

4. (original) The method of claim 1 wherein the silicon nitride layer is formed by a chemical vapor deposition process.

5. (original) The method of claim 1 wherein the doped silicate glass film is removed by an anisotropic etching process.

6. (original) The method of claim 1 wherein the silicon nitride layer is removed by an anisotropic etching process.

7. (original) A method for forming a deep trench capacitor buried plate comprising:

providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;

performing a dry etching process for forming a deep trench in the substrate via the opening;

depositing a doped silicate glass film on an inner wall of the deep trench;

filling a sacrificial layer into the deep trench;

removing a portion of the sacrificial layer for exposing parts of the doped silicate glass film;

performing an etching process to remove the exposed doped silicate glass film and a portion of the pad nitride layer for forming a recess;

removing the remaining sacrificial layer;

depositing a silicon nitride layer on the inner wall of the deep trench;

performing a diffusing process for forming a doped region at a bottom of the trench;

removing the silicon nitride layer; and

removing the doped silicate glass film;

wherein the silicon nitride layer serves as a barrier layer for preventing ions of the doped silicate glass film from diffusing into a collar region of the deep trench.

8. (original) The method of claim 7 wherein the doped silicate glass film is an arsenic silicate glass (ASG) film.

9. (original) The method of claim 8 wherein the arsenic silicate glass film is formed by a chemical vapor deposition (CVD) process.

10. (original) The method of claim 7 wherein the silicon nitride layer is formed by a chemical vapor deposition process.

11. (original) The method of claim 7 wherein the etching process is an anisotropic etching process.

12. (original) The method of claim 7 wherein the silicon nitride layer is removed by an anisotropic etching process.

1. Rejection of claims 1-6 under 35 U.S.C. 102(b) as being anticipated by Wensley et al. (US 6,316,310):

Regarding US 6,316,310, Wensley discloses a method of forming a buried plate including (refer to col.2 lines 21-64, and Figs.1-9):

depositing a silicon nitride layer 102 on a wafer 100;

forming a trench 104;

<u>forming an arsenic doped glass layer 106 within the trench 104 and over the silicon nitride layer 102</u>;

<u>depositing an undoped glass layer (capping layer) 108 on the arsenic</u>

doped glass layer 106;

forming a photoresist layer (sacrificial layer) 110 which fills the trench 104;

etching back the photoresist layer 110 in the trench 104 to a predetermined depth;

etching the arsenic doped glass layer 106 and the undoped glass layer 108 unprotected by the photoresist layer 110;

removing the remaining photoresist layer 110;

performing an annealing process to out-diffuse arsenic from the arsenic doped glass layer 106; and

removing the arsenic doped glass layer 106 and the undoped glass layer 108.

Claim 1 of the present application discloses a method for forming a deep trench capacitor buried plate including:

providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;

performing a dry etching process for forming a deep trench in the substrate via the opening;

depositing a doped silicate glass film on an inner wall of the deep trench;

filling a sacrificial layer into the deep trench;

etching back the sacrificial layer for exposing parts of the doped silicate glass film;

removing the exposed doped silicate glass film;

removing the remaining sacrificial layer;

depositing a silicon nitride layer on the inner wall of the deep trench;

performing a thermal process for forming a doped region at a bottom of the trench;

removing the silicon nitride layer; and
removing the doped silicate glass film;
wherein the silicon nitride layer serves as a barrier layer for preventing ions of the doped silicate glass film from diffusing into a collar region of the deep trench.

The method of claim 1 is characterized by depositing a silicon nitride layer 64 (refer to Fig.7) as a barrier layer after removing the sacrificial layer. The silicon nitride layer 64 covers the upper portion of the deep trench (collar region), and therefore prevents diffusion of arsenic into the collar region of the deep trench. With regard to US 6,316,310, although the method of Wensley includes forming an undoped glass layer (capping layer) 108 on the arsenic doped glass layer 106, the undoped glass layer 108 is formed before forming the photoresist layer 110. Consequently, the undoped glass layer 108 does not protect the upper portion of the trench (collar region), and therefore is unable to prevent diffusion of arsenic into the collar region. In addition, Wensley fails to teach or suggest forming the undoped glass layer 108 after removing the photoresist layer 110. Thus, the method recited in claim 1 is not obvious to Wensley's teaching. Reconsideration of claims 1-6 is respectfully requested in view of the above argument. Claims 2-6 depend on claim 1 and should be allowed if claim 1 is found allowable.

2. Rejection of claims 7-12 under 35 U.S.C. 102(b) as being anticipated by Wemsley et al. (US 6,316,310):

Regarding US 6,316,310, Wensley discloses a method of forming a buried plate including (refer to col.2 lines 21-64, and Figs.1-9):

depositing a silicon nitride layer 102 on a wafer 100;
forming a trench 104;

<u>forming an arsenic doped glass layer 106 within the trench 104 and over the silicon nitride layer 102;</u>

<u>depositing an undoped glass layer (capping layer) 108 on the arsenic doped glass layer 106;</u>

<u>forming a photoresist layer (sacrificial layer) 110 which fills the trench 104;</u>

etching back the photoresist layer 110 in the trench 104 to a predetermined depth;

etching the arsenic doped glass layer 106 and the undoped glass layer 108 unprotected by the photoresist layer 110;

removing the remaining photoresist layer 110;

performing an annealing process to out-diffuse arsenic from the arsenic doped glass layer 106; and

removing the arsenic doped glass layer 106 and the undoped glass layer 108.

Claim 7 of the present application claims a method for forming a deep trench capacitor buried plate including:

providing a substrate having a pad oxide layer and a pad nitride layer thereon, the pad oxide layer and the pad nitride layer having at least an opening;

performing a dry etching process for forming a deep trench in the substrate via the opening;

depositing a doped silicate glass film on an inner wall of the deep trench;

filling a sacrificial layer into the deep trench;

removing a portion of the sacrificial layer for exposing parts of the doped silicate glass film;

<u>performing an etching process to remove the exposed doped silicate glass film and a **portion of the pad nitride layer for forming a recess**</u>;

removing the remaining sacrificial layer;
depositing a silicon nitride layer on the inner wall of the deep trench;
performing a diffusing process for forming a doped region at a bottom of the trench;
removing the silicon nitride layer; and
removing the doped silicate glass film;
wherein the silicon nitride layer serves as a barrier layer for preventing ions of the doped silicate glass film from diffusing into a collar region of the deep trench.

The method of claim 7 is characterized by two aspects. First, a portion of the pad oxide layer 52 (refer to Fig.6) is removed to form a recess 62, and the silicon nitride layer is filled in the recess 62 (refer to paragraph [0018]). This step prevents enlargement of the deep trench (refer to paragraph [0022]). Second, the silicon nitride layer 64 (refer to Fig.7) is deposited as a barrier layer after removing the sacrificial layer. The silicon nitride layer 64 covers the upper portion of the deep trench (collar region), and therefore prevents diffusion of arsenic into the collar region of the deep trench.

With regard to US 6,316,310, Wensley does not teach any steps of forming a recess. Besides, although the method of Wensley includes forming an undoped glass layer (capping layer) 108 on the arsenic doped glass layer 106, the undoped glass layer 108 is formed before forming the photoresist layer 110. Consequently, the undoped glass layer 108 does not protect the upper portion of the trench (collar region), and therefore is unable to prevent diffusion of arsenic into the collar region. In addition, Wensley fails to teach or suggest forming the undoped glass layer 108 after removing the photoresist layer 110. Thus, the method recited in claim 7 is not obvious to Wensley's teaching. Reconsideration of claims 7-12 is respectfully requested in view of the above argument.

Claims 8-12 depend on claim 7 and should be allowed if claim 7 is found allowable.

Sincerely,

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